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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No. :	10/605,408	Confirmation No. 2407
Applicant :	Kern Rim	
Filed:	September 29, 2003	
TC/Art Unit:	2813	
Examiner :	James M. Mitchell	
Docket No. :	YOR920000707US2	
Customer No. :	27127	

Commissioner for Patents  
P.O. Box 1450  
Alexandria VA 22313-1450

**DECLARATION UNDER 37 CFR §1.131**

I, Kern Rim, depose and say that:

(1) I am the sole inventor of the subject matter covered by each of the claims pending in the above-identified U.S. patent application (the "Application").

(2) I am currently employed with International Business Machines Corp. (IBM), the assignee of the Application.

(3) Prior to February 7, 2002, I conceived and completed, in this country, my disclosed and claimed invention for a method of forming a strained silicon-on-insulator (SSOI) structure involving the steps of: forming a silicon layer on a strain-inducing layer with a different lattice constant than

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Application No. 10/605,408  
Technology Center 2813

silicon so that the silicon layer is strained; bonding the resulting multilayer structure to a substrate so that an insulating layer is between the strained silicon layer and the substrate; and then removing the strain-inducing layer to yield a strained silicon-on-insulator structure comprising the substrate, the insulating layer on the substrate, and the strained silicon layer on the insulating layer. Completion of this method is evidenced attached hereto as Exhibits A through G, each of which are documents in existence prior to February 7, 2002.

(4) Exhibit A is a split table detailing eight "wafer types" to be prepared according to the method recited in claims of the Application.

(5) Exhibit B is an email in which I requested 20% SiGe wafers identified in the table of Exhibit A.

(6) Exhibit C is an email confirming receipt of the wafers requested in Exhibit B and discussing an experiment underway on the wafers. At this point the success of the process was uncertain, as evident from this email.

(7) Exhibit D is an email reporting progress in the experiment and requesting assistance in removing the strain-inducing SiGe layer from the experimental wafers.

Application No. 10/605,408  
Technology Center 2813

(8) Exhibit E is an email which expresses anticipated good results when the experiment is completed within a period prior to February 7, 2002.

(9) Exhibit F is an email that discusses carrying out the final step of etching to remove the SiGe layer of the SSOI wafers already processed in the experiment. This final step was successfully completed prior to February 7, 2002. In particular, I recall that Kevin Chan (also an employee of IBM) and I completed experiments prior to 2002, during which we removed the SiGe layer of the SSOI wafers by CMP and etch and confirmed (I believe by deep UV Raman spectroscopy) that the strain was retained in the silicon layers after removal of the SiGe layers. Furthermore, by the time I submitted my invention disclosure to the IBM Intellectual Property Law Department in 2000, I had concluded that the bond strength at the Si-SiO<sub>2</sub> interface would be strong enough to retain the strain in the Si layer based on my research of published bonding energy information. Therefore, even before I confirmed the strain retention through actual testing (as discussed above), I had high confidence that my invention of a silicon layer with strain induced by a SiGe layer and then bonded to an oxide layer would remain strained after removing the SiGe layer.

Application No. 10/605,408  
Technology Center 2813

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.



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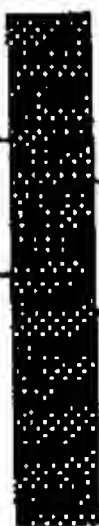
Kern Rim

# Exhibit A

A	B	C	D	E	F
1	SSST11				
2					
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9					
10					
11					
12					
13					

Wt#	Water ID	Water Type	Wafer Note	Description	Description
1	M518E9F	20%	20SS006 350A	SSOI	
2	M218CNE	20%	20SS006 350A	SSOI	
3	M018WAF	15%	15SS002 350A	SSOI	
4	M218WBF	15%	15SS002 350A	SSOI	
5	M218BLF	A 20% SiGe + 500A Si	DSG002	Control thin SOI	
6	M9188VF	A 20% SiGe + 500A Si	DSG002	Control thin SOI	
7	M2187KF	A 20% SiGe + 500A Si	DSG002	Control thin SOI	
8	M7187FF	A 20% SiGe + 500A Si	DSG002	Control thin SOI	

Experiment Split Table from



File name: SSOIL.123

## Exhibit B



Ken Rimm/Watson/IBM



To: Jack O Chu

cc

bcc

Subject: wafers

Jack,

I would like to release Center 1 device lot next week. How is the wafer situation these days? I'd need 5 15% and 5 20% wafers.

Other wafer needs that are imminent:

SSOI experiment: 4 with ~500 A pseudomorphic SiGe 20%  
273 SiGe buffer wafers (Si cap does not matter) for CMP practice (don't have to be device grade)

Ron's silicide experiment

I'll give you a call when I get back tomorrow. Thanks!

Ken

-----  
Ken Rimm

IBM T. J. Watson Research Center  
P. O. Box 218 / Route 134  
Yorktown Heights, NY 10598  
Phone: 914-945-2846  
E-mail: rim@us.ibm.com

## Exhibit C



Ken Rim/Watson/IBM

To Erin C Jones/Watson/IBM@IBMUS



cc Mekai Leong/Fiskill/IBM@IBMUS

bcc

Subject \*IBM Confidential: soci experiment

Erin,

Remember that crazy idea I talked to you about back in fall? Transferring strained Si right on insulator?

I finally got a few wafers from Jack and gave them to Leathen. (We had the superthk run sheet written a while ago.) The goal of this experiment is simply to check if the transferred layer can retain any of the strain. If any of the strain is indeed retained, we will want to do some annealing experiments, and I am hoping your group (Kevin, new hire, etc.) and Jack can help with taking the idea further. It's essentially very similar to what is known as "Ultra-Cut", and should be interesting just a way to create a thin, uniform SOI even if it is not strained.

I think it is a risky experiment in terms of rate of success, but if it works, I think this could be something we can consider for beyond 11S.

Just thought I would let you know in case you have any concerns or objections. Right now, I wanted to keep it as a very low key low profile experiment, mostly because it might turn out to be a bad idea.

Ken



Ken Rim

IBM T. J. Watson Research Center

P. O. Box 218 / Route 134

Yorktown Heights, NY 10598

Phone: 914-945-2946

E-mail: rim@us.ibm.com

## Exhibit D



Ken Rlm/Watson/IBM

To Jack O Chu/Watson/IBM@IBMUS

cc Leathen Shi/Watson/IBM@IBMUS

bcc

Subject SSOI experiment

Jack,

Leathen finished bonding, grinding back, and CMP on the strained Si-directly-on-insulator. He has 6 (I think) wafers. A couple of them are control wafers with Sipsseudomorphic SiGe stacks.

The next steps were going to be thickness measurement by nanospec, litho patterning to put some patterns for easy step height measurement, and careful selective etch of SiGe. Since I've been busy, I've been just waiting for the right moment to do this.

When you mentioned the SSOI at today's meeting, I just remembered. Since you have some experience with HHA etch, and since you may have some time now while your reactor is down, if you want to join this experiment, maybe you can help with the etch back? I was going to first do some etch rate test on blanket SiGe wafers, and then break up one of the wafers to try the etch back on pieces

Let me know if you are interested.

Thanks.

Ken

Ken Rlm

IBM T. J. Watson Research Center

P. O. Box 218 / Route 134

Yorktown Heights, NY 10598

Phone: 914-945-2346

E-mail: rlm@us.ibm.com



## Exhibit E



Jack O Chu/Watson/IBM

To Ken Rim/Watson/IBM@IBMUS, Erin C

Jones/Watson/IBM@IBMUS, Mei-kei  
leong/Fishkill/IBM@IBMUS, Kevin K  
Chan/Watson/IBM@IBMUS, Suri  
Hegde/Watson/IBM@IBMUS, Leathan  
Shi/Watson/IBM@IBMUS  
cc Alfred Grill/Watson/IBM@IBMUS, H-S Philip  
Wong/Watson/IBM@IBMUS

bcc

Subject IBM Confidential: SSOI and SGOI

- Ken,

I've already started a couple of runs with Leathan for making t-SGOI & SSOI and hopefully in the next month or so, I'll have some "good" results.

-- Jack

Dr. Jack O. Chu  
Electronic Materials & Structures Group  
IBM T.J. Watson Research Center

Internet: chu@us.ibm.com

Notes: Jack O. Chu/Watson/IBM@IBMUS  
Phone: (914) 945-2709, Fax: 945-4581

----- Forwarded by Jack O Chu/Watson/IBM on 12/13/2006 2:16 PM -----

Ken Rim

To: Erin C Jones/Watson/IBM@IBMUS, Kevin K Chan/Watson/IBM@IBMUS, Suri  
Hegde/Watson/IBM@IBMUS, Leathan Shi/Watson/IBM@IBMUS, Jack O Chu/Watson/IBM@IBMUS  
cc: Mei-kei leong/Fishkill/IBM@IBMUS  
From: Ken Rim/Watson/IBM@IBMUS  
Subject: IBM Confidential: SSOI and SGOI

## Exhibit F



Ken Rini/Watson/IBM



To Jack O Chu/Watson/IBM@IBMUS

cc Alfred Grill/Watson/IBM@IBMUS, Erin C  
Jones/Watson/IBM@IBMUS, Kevin K  
Cham/Watson/IBM@IBMUS, Leathan  
Shi/Watson/IBM@IBMUS, Meiwei  
Jeong/Fishkill/IBM@IBMUS, Suri  
Hegde/Watson/IBM@IBMUS

bcc

Subject Re: "IBM Confidential: SSOI and SGOI"

Jack,

How far are you along with the process? Leathan bonded a few SSOI wafers (wafers you grew) for me (just SSOI, not SGOI) back last winter, and they have been just waiting for the HHA etching experiments. So they are already etched back down to the SiGe layer, and I just never had time to do the next steps - iterations to etch SiGe and stop on Si. I was going to ask Suri to help us drive this experiment and start a new batch with a couple of other ideas. Can we work with you, especially on these few wafers that are all ready for the last step, to get the HHA etch to work?

Ken

Ken Rini

IBM T. J. Watson Research Center  
P. O. Box 218 / Route 134  
Yorktown Heights, NY 10598  
Phone: 914-945-2946  
E-mail: [rm@us.ibm.com](mailto:rm@us.ibm.com)

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Alexandria VA 22313-1450

**DECLARATION UNDER 37 CFR §1.131**


I, Kevin C. Chan, depose and say that:

- (1) I am currently employed with International Business Machines Corp. (IBM), the assignee of the above-identified U.S. patent application (the "Application"), as a researcher at the IBM T. J. Watson Research Center.
- (2) I am very familiar with the method described in the original and pending claims of the Application.
- (3) I assisted Kern (Ken) Rim, the inventor and applicant of the Application, in completing the invention described in the Application by performing and completing experiments on behalf of Mr. Rim.

Application No. 10/605,408  
Technology Center 2813

(4) As evidenced by the attached pages of my experiment notebooks, the SiGe material and method described and claimed in the Application were successfully developed and completed prior to February 7, 2002. Included in the attached pages, under the title "RTCVD SiGe 25% (repeated) with 200A strained-Si," are the parameters employed in the successful method, including process flow rate, pressure, temperature, and wafer ID.

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

 12/12/2006  
Kevin C. Chan

Application No. 10/605,408  
Technology Center 2813

Attachment Contents:

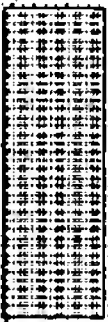
- Page 1 Title and number of IBM official research laboratory notebook, which is systematically dated from 1986 to present. This particular notebook #13 was started prior to the year 2001, and contains the following Pages 2 through 5.
- Page 2 Notes from discussion with Ken Rim. Experiment and structure set up.
- Page 3 Experimental results of a film stack which created strained silicon from SiGe.
- Page 4 Email in which Ken Rim requested wafers for transistor fabrication.
- Page 5 Material results verification for strained silicon.

Attachment to Declaration of Kevin C. Chan  
Page 1

**LABORATORY NOTEBOOK**

Notebook No.: 415

Assigned to: Kevin Chan

Date: 

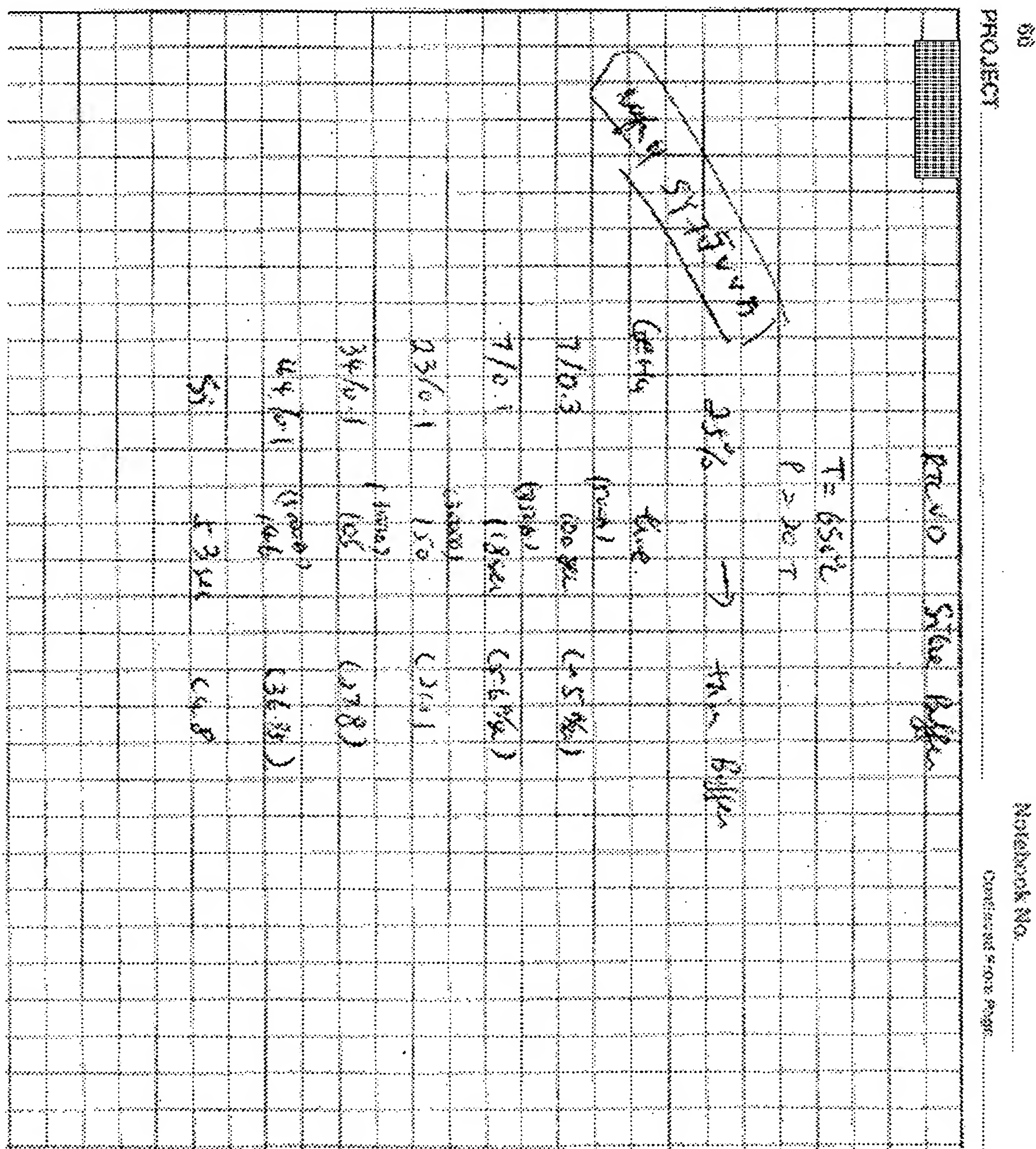
© 1993, 1998, 2000, 2001  
Published: New York  
Printed: 2001



Attachment to Declaration of Kevin C. Chan  
Page 2

K. Chan  
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Attachment to Declaration of Kevin.C. Chan  
Page 3





Attachment to Declaration of Kevin C. Chan  
Page 4

Ken Rim

To: Karen K. Chao/Massachusetts, Jan O. Chu/Hawaii, Susan Roper/Wisconsin, Paul S. East/Jamaica, William B. Lewis/Michigan, Scott Kern/Kentucky, Bob Smith/South Carolina, Robert C. Condit/North Carolina, John Waters/Delaware, Thomas A. Leggett

cc: Ken Rim/Hawaii, Jeffery M. Smith/California, Paul S. East/Jamaica, William B. Lewis/Michigan, Scott Kern/Kentucky, Bob Smith/South Carolina, Robert C. Condit/North Carolina, John Waters/Delaware, Thomas A. Leggett

MJR:

To recap what we decided yesterday for Center 3, I will use the following waters:

EZ	3 waters	Karin Chan from AGTUS work
EF 16%	3 waters	Jack Chu
YRT RT 15%	3 waters	Karen Chan
VAT RT 34%	2 waters	Karen Chan
VKT RT 35%	1 water	Nicko Chan

I would like to release the lot by Wed. which means I will need the waters with SOA HTO dry-ated by Wed.

Jack can you please make sure you give 3 waters to Karin before you leave for MHST?

Karen, can you give me an idea when you can get me the waters? (I.e. if you will need more time, etc.)

Thanks very much!

Kern

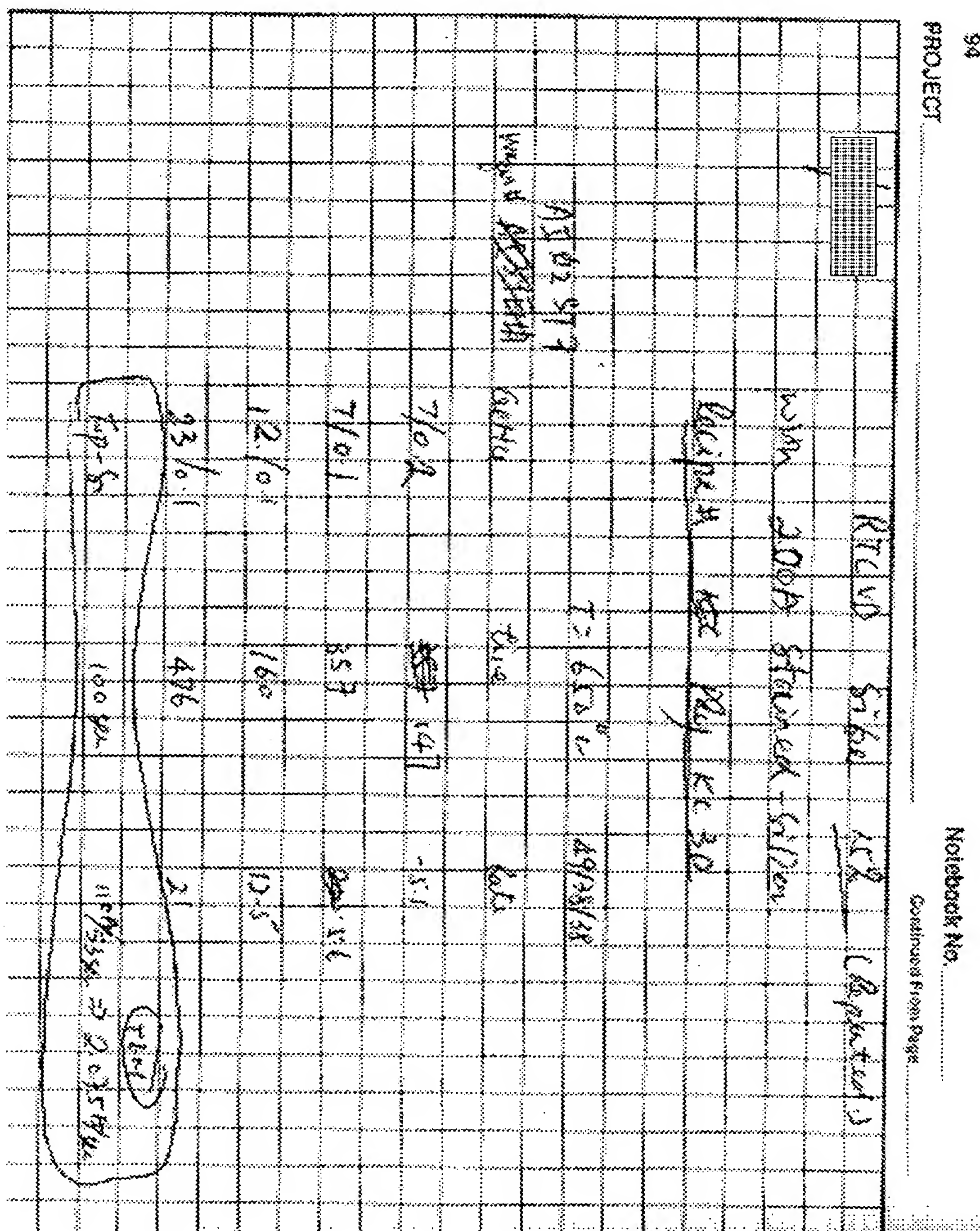
Kern Rim  
EMIT J Wilson Research Center  
P.O. Box 318 Route 134  
Watkins Heights, NY 10996  
Phone: 814.445.2946  
E-mail: kern@us.ibm.com

(EF) 16% Kern \* 662  
wpt = 10 - 113361KIF  
Ken Rim (6-28-3)

(EE) 15% Kern \* 662  
wpt = 11 - 113361JUF  
Ken Rim (6-28-3)

(EF) 15% Kern \* 662  
wpt = 1C - 113361MUF  
Ken Rim (6-28-3)

Attachment to Declaration of Kevin C. Chan  
Page 5



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- ☒ **COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- ☐ **GRAY SCALE DOCUMENTS**
- ☐ **LINES OR MARKS ON ORIGINAL DOCUMENT**
- ☐ **REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
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